

Evaluation of the Frequency of Shaldon's Catheter Complications in the Hemodialysis Patients in Ahvaz Razi Hospital

ALI HASSAN RAHMANI¹, BABAK HAZRATI², HADIS ALIDADI^{3*}

¹Department of Clinical Poisoning, Razi Hospital, Faculty of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.

²Graduated from General Ph.D., Faculty of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.

³Department of Pharmacology and Toxicology, School of Pharmacy, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.

Abstract

Objective: The insertion of central venous catheters in patients with chronic renal failure and poisoning is a vital step for these patients. Therefore, it is necessary to know the complications and clinical applications of these catheters. The aim of this study was to identify catheter complications in patients with Shaldone dialysis catheter and the choice of the best method for preventing the occurrence of these complications in patients.

Methods: The study population consisted of all patients, who were admitted in the ICU poisoning for dialysis and used Shaldon's catheter. Information including age, sex, cause of admission, duration of admission, duration of catheterization, the type of complication, and the use of Shaldon's catheter were extracted from patients' files and special forms.

Results: Among the 80 patients, who had Shaldone's catheter, 59 were uncomplicated and 21 were complicated. The most common complication was catheter site infection (8.8%). There were 5% of patients with pneumothorax, 5% with bleeding, 2.5% with thrombosis, 1.3% hemothorax, 1.3% hematoma, 1.3% pneumothorax plus hemothorax, and 1.3% catheter site infection along with thrombosis.

Conclusions: According to the pertinent literature, if the experienced patients practice catheterization, the internal jugular catheter is a more appropriate and feasible approach than femoral. It is recommended to conduct catheterization by experienced individuals with the introduction of a catheter and under the guise of ultrasound to minimize the occurrence of some complications

Keywords: Catheter; Complications; Hemodialysis; Poisoning.

How to cite this article: Rahmani HA, Hzrati B, Alidadi H. Evaluation of the Frequency of Shaldon's Catheter Complications in the Hemodialysis Patients in Ahvaz Razi Hospital. *Asia Pac J Med Toxicol* 2022; 11(2):58-61.

INTRODUCTION

Central venous catheters are used to administer intravenous drug therapies, fluids, blood sampling, and hemodialysis [1]. More than 15% of patients have catheter complications [2]. Catheter insertion may result in thrombotic (2-26%) [3, 4] and infectious (5-26%) [5-7] complications. Temporary hemodialysis catheters often possess delayed and premature complications [8, 9]. The most common of complication is infection with an incidence 0.46 to 30 per 1000 catheter days [10]. In addition, mechanical complications such as pneumothorax, hemothorax, and thrombosis may occur [11]. Catheter use may also result in air embolism and cardiac arrhythmias that are not common [12]. About 5 million central venous catheters are used annually in the United States [13, 14]. Central vein catheters are inserted through the cutaneous in large veins such as jugular, subclavian, and femoral [15]. The choice of location for insertion of central venous catheter in

patients depends on the degree of failure and its complications [16]. Surgeons choose a method based on the disadvantages and advantages of each of these methods.

Therefore, the aim of this study was to identify catheter complications in patients with Shaldone dialysis catheter and the choice of the best method for preventing the occurrence of these complications in patients.

METHODS

This epidemiological study is descriptive and based on hospital data of dialysis patients, who referred to ICU poisoning department of Ahvaz Razi Hospital between March 2013 and February 2015. The study population consisted of all patients, who were admitted in the ICU poisoning for dialysis and used Shaldon's catheter. Information including age, sex, cause of admission, duration of admission, duration of catheterization, the type of complication, and the use of Shaldon's catheter were extracted from patients' files and special forms.

*Correspondence to: Hadis Alidadi, PhD, Department of Pharmacology and Toxicology, School of Pharmacy, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.

Tel: +989373502874, E-mail: hadisa40@yahoo.com

Data Analysis

After collecting information about the patients, the findings were analyzed using SPSS-20. Descriptive statistics (abundance, graphs) were used to represent percentages. The mean for quantitative variables was used and the frequency and percentage for qualitative variables were used. Also, to compare the ratio of the incidence of complications of intubation, the comparison of ratios was used.

RESULTS

In this study, 80 patients using catheters for dialysis in Razi hospital in Ahavaz city were enrolled. The minimum and maximum ages were 13 and 87, respectively. There were 49 males and 31 females. The patients included 30 cases of pesticides poisoning, 23 cases with drug poisoning, 8 cases of alcohol poisoning, 3 cases snake bite, 9 cases scorpion bite, and 7 cases with sepsis. The average of time of using catheter in patients was 5.5 days. The minimum and maximum of time was 1 and 26 days, respectively. 16 patients used catheter in 3 days that was a high percent (20%). Catheter placement was performed in 42 patients in the jugular vein, 37 in the femoral vein, and one in the subclavian vein (Table 2). Table 3 shows the frequency of complications in patients admitted to ICU poisoning section of Ahvaz Razi Hospital. Among the 80 patients, who had Shaldone's catheter, 59 were uncomplicated and 21 were complicated. The most common complication was catheter site infection (8.8%). There were 5% of patients with pneumothorax, 5% with bleeding, 2.5% with thrombosis, 1.3% hemothorax, 1.3% hematoma, 1.3 % pneumothorax plus hemothorax, and 1.3% catheter site infection along with thrombosis.

DISCUSSION

The aim of this study was to evaluate the complications of Shaldon's catheter occurring in hemodialysis patients in Ahvaz Razi Hospital. The results showed that among 80 patients, 59 patients were uncomplicated and 21 patients (26.2%) had complications. A study by Beigi and colleagues on dialysis patients showed that among 114 patients, 30

patients had central vein catheter related complications which matched our results [17]. They also showed that the percentage of complications in males and females was 28.5 and 29, respectively and indicated that the incidence of complications in males and females was equal [17]. Borges et al reported that catheter-related complications have occurred in men more than women (31% in men and 17% in women) and most of the catheters used in men were femoral vein. In addition, they reported that there was no direct relationship between the age of hospitalized patients and catheter-related complications, except for bleeding [18]. The results of the present study showed that the most common catheter-related complication is infection of the catheter site (10%) and this incidence rate in the study by Beigi was 15.3 percent. In 2007, Di Lorio demonstrated that 10% of the patients had an infection due to the placement of the catheter [19]. In 2006, a survey of 68 children in the hemodialysis department of Sheikh Mashhad's specialist hospital showed that the most frequently complication related to central vein catheters was infection of catheter site (48.1%). Since the health care in adults is better than children, this high rate of infection in children can be is justified. In the current study, the duration

Table 3. Frequency of Complications in Patients Admitted to the ICU Department of Poisoning in Ahvaz Razi Hospital

Type of Complication	Frequency	Percentage
Pneumothorax	4	5%
Hemothorax	1	1.3%
Bleeding	4	5%
Infection of catheter site	7	8.8%
Thrombosis	2	2.5%
Pneumothorax plus Hemothorax	1	1.3%
Site infection plus Thrombosis	1	1.3%
Hematoma	1	1.3%
Uncomplicated	59	73.8%
Total	80	100%

Table 1. the Number of samples by gender

Gender	Frequency	Percentage	Crude percentage	Cumulative frequency
Male	49	61.2	61.2	61.2
Female	31	38.8	38.8	100
Total	80	100	100	

Table 2. Place of catheter insertion in patients admitted to ICU poisoning department of Ahvaz Razi Hospital

Place of Catheter Insertion	Frequency	Percentage	Crude percentage	Cumulative frequency
Jugular	42	52.5	52.5	52.5
Femoral	37	46.3	46.3	98
Subclavian	1	1.2	1.2	100
Total	80	100	100	

of catheterization had a significant relationship with the incidence of infection, so that one hundred the percentage of infections occurred after the sixth day of catheterization. In a similar manner, Gil et al showed that catheter site infection increased by 1.5% to 10% with a catheterization period of more than 6 days. In this study, 75% of the total infection occurs when using the femoral approach [20]. In 2009 and 1998, respectively, Knuttinen and Goetz reported that the onset of infection is most common when using a femoral catheter [21, 22]. Furthermore, Parienti found that when using femoral catheter, the prevalence of catheter tip infection is significantly higher than jugular catheter and subclavian [23]. Because femoral area is susceptible to bacterial infection, it can be justified that more infections occur in this area. In this study, the authors investigated 80 patients and found that the rate of pneumothorax and hemothorax occurrence was 8.7 percent. Because these complications only occurred when using jugular and subclavian approaches (43 cases), the actual percentage is 16.1 percent (7 of 43 cases) which is more than previous studies. In a study on dialysis patients, Abdoulhosseini et al showed that the mean incidence of pneumothorax and hemothorax was 6 % and 5%, respectively[24]. While Shahmoradi reported only one case of pneumothorax in relation to catheterization complications [5]. Develter also maintained that catheterization-induced pneumonia was less than 1% [25]. The reason for this difference can be attributed to the lack of facilities for the insertion of ultrasound catheters and lack of skill and follow up on the catheter insertion. It is necessary to use a radiograph of the tip of the catheter to connect the upper inferior vein to the right atrium, ensuring proper placement of the catheter during and end of the work, and also the absence of pneumothorax and hemothorax. Obviously, the placement of an ultrasound catheter minimizes the chance of developing these complications. In the present study, the incidence rate of bleeding was 5% of the patients and 21% of the total complications, which was more than the results of the study of Bambauer (2.4%). A remarkable point in relation to patients admitted to the ICU section of poisoning was the occurrence of coagulation and blood disorders due to various types of bites, which justifies the bleeding incidence of 5% in this study.

Additionally, in this study, the incidence of bleeding increased significantly with age ($P < 0.05$) and all bleeding occurred in age more than 26 years. The incidence rate of thrombosis was 12.65% of the all complications. Likewise, Leung et al showed that the incidence of deep venous thrombosis and superficial thrombosis was 1.8 and 9.2%, respectively [26]. With respect to the study by Scholz, an important factor in the formation of thrombosis is damage to the wall of the vein [27]. Handling and intravenous trauma, especially when inserting a catheter, and in addition, a larger catheter diameter is one of the causes of more thrombosis. It can be contended that the incidence of thrombosis, in this study, is due to the lack of experience of the personnel, multiple attempts at catheterization, as well as the lack of facilities for the insertion of an ultrasound catheter. The incidence of hematoma, in this study, was 1.3% of patients

(4.34% of all complications). Istrate and Mansfield reported that the incidence rate of hematoma following catheter placement was 3.5% and 0.6%, respectively [28]. Bambauer showed that repeated attempts to fit a catheter eventually lead to an extensive vascular hematoma [29]. It seems that having experience and expertise in reducing the incidence of hematoma has a crucial role. In general, in this study, 52.17% of the total complications were related to femoral catheter and 47.82% of complications were related to jugular and subclavian catheters. Of the 25.5% complications associated with the jugular catheter and subclavian, the highest contribution was made by pneumothorax and hemothorax (16%). The results showed that the incidence rate of complications was 67.5% in femoral catheter and 32.5% in jugular and subclavian catheters.

CONCLUSION

This study showed that a significant number of patients treated in the ICU section of the poisoning at the Razi Hospital of Ahvaz only benefited from the benefits of catheters and did not directly affect any of the complications of the catheter and its placement. This study shows that the rate of complications is lower than previous studies, and it can be concluded that the benefits of using catheters are more than their damage. However, the incidence rate of pneumothorax and hemothorax as two complications was much higher than usual. Hence, the femoral catheter appears to be a safer way. However, according to previous studies, if the experienced patients practice catheterization, the internal jugular catheter is a more appropriate and feasible approach than femoral. It is recommended to conduct catheterization by experienced individuals with the introduction of a catheter and under the guise of ultrasound to minimize the occurrence of some complications.

LIMITATIONS

Although the retrospective design of the study limited the data that could be collected and thorough follow-up of patients, we believe that the number of possible missed cases was low.

ACKNOWLEDGMENTS

The authors would like to acknowledge the ICU poisoning department of Ahvaz Razi Hospital for their cooperation and patience in providing registries needed for collecting retrospective data.

Funding and Support: None.

Conflict of Interest: None to be declared.

REFERENCES

1. Napalkov P, Felici DM, Chu LK, Jacobs JR, Begelman SM. Incidence of catheter-related complications in patients with central venous or hemodialysis catheters: a health care claims database analysis. *BMC cardiovascular disorders*. 2013;13(1):86.
2. Pittet D, Tarara D, Wenzel RP. Nosocomial bloodstream infection in critically ill patients: Excess length of stay, extra costs, and attributable mortality. *Jama*. 1994;271(20):1598-601.

3. Merrer J, De Jonghe B, Golliot F, Lefrant J-Y, Raffy B, Barre E, et al. Complications of femoral and subclavian venous catheterization in critically ill patients: a randomized controlled trial. *Jama*. 2001;286(6):700-7.
4. Sznajder JI, Zveibil FR, Bitterman H, Weiner P, Bursztein S. Central vein catheterization: failure and complication rates by three percutaneous approaches. *Archives of internal medicine*. 1986;146(2):259-61.
5. Kazem Shahmoradi M, Khavaninzadeh M, Mousavi Kani K. Catheter related complications and survival among Iranian ESRD patients treated in Hasheminejad hospital; 2010-2011. *Razi Journal of Medical Sciences*. 2013;19(105).
6. Oliver MJ, Callery SM, Thorpe KE, Schwab SJ, Churchill DN. Risk of bacteremia from temporary hemodialysis catheters by site of insertion and duration of use: a prospective study. *Kidney international*. 2000;58(6):2543-5.
7. Veenstra DL, Saint S, Saha S, Lumley T, Sullivan SD. Efficacy of antiseptic-impregnated central venous catheters in preventing catheter-related bloodstream infection: a meta-analysis. *Jama*. 1999;281(3):261-7.
8. Daugirdas JT, Blake PG, Ing TS. *Handbook of dialysis*: Lippincott Williams & Wilkins; 2012.
9. Askegard-Giesmann JR, Caniano DA, Kenney BD, editors. Rare but serious complications of central line insertion. *Seminars in pediatric surgery*; 2009: Elsevier.
10. Levy I, Bendet M, Samra Z, Shalit I, Katz J. Infectious complications of peripherally inserted central venous catheters in children. *The Pediatric infectious disease journal*. 2010;29(5):426-9.
11. Kingdon EJ, Holt SG, Davar J, Pennell D, Baillod RA, Burns A, et al. Atrial thrombus and central venous dialysis catheters. *American journal of kidney diseases*. 2001;38(3):631-9.
12. Poort SR, Rosendaal FR, Reitsma PH, Bertina RM. A common genetic variation in the 3'-untranslated region of the prothrombin gene is associated with elevated plasma prothrombin levels and an increase in venous thrombosis. *Blood*. 1996;88(10):3698-703.
13. Kilbourne MJ, Bochicchio GV, Scalea T, Xiao Y. Avoiding common technical errors in subclavian central venous catheter placement. *Journal of the American College of Surgeons*. 2009;208(1):104-9.
14. GHANE SF. Comparison of the complications of central vein catheters and arterio-venous fistulae in children on chronic hemodialysis. 2006.
15. Ayas NT, Norena M, Wong H, Chittock D, Dodek PM. Pneumothorax after insertion of central venous catheters in the intensive care unit: association with month of year and week of month. *BMJ Quality & Safety*. 2007;16(4):252-5.
16. Akmal A, Hasan M, Mariam A. The incidence of complications of central venous catheters at an intensive care unit. *Annals of thoracic medicine*. 2007;2(2):61.
17. Beigi AA, Ghaheri H, Jazi AHD, Alavi L. The Efficacy and Complications of Temporary and Permanent Central Venous Catheters in Patients with Renal Failure. *Journal of Isfahan Medical School*. 2012;29(163).
18. Borges PdRR, Bedendo J. Risk factors associated with temporary catheter-related infection in patients on dialysis treatment. *Texto & Contexto-Enfermagem*. 2015;24(3): 680-5.
19. Di Iorio B, Lopez T, Procida M, Marino P, Valente V, Iannuzziello F, et al. Successful use of central venous catheter as permanent hemodialysis access: 84-month follow-up in Lucania. *Blood purification*. 2001;19(1):39-43.
20. Gil RT, Kruse J, Thill-Baharozian MC, Carlson R. Triple-vs single-lumen central venous catheters. *Arch Intern Med*. 1989;149:1139-43.
21. Knuttinen M-G, Bobra S, Hardman J, Gaba RC, Bui JT, Owens CA, editors. A review of evolving dialysis catheter technologies. *Seminars in interventional radiology*; 2009: Thieme Medical Publishers.
22. Goetz AM, Wagener MM, Miller JM, Muder RR. Risk of infection due to central venous catheters: effect of site of placement and catheter type. *Infection Control & Hospital Epidemiology*. 1998;19(11):842-5.
23. Parianti J-J, Mongardon N, Mégarbane B, Mira J-P, Kalfon P, Gros A, et al. Intravascular complications of central venous catheterization by insertion site. *New England Journal of Medicine*. 2015;373(13):1220-9.
24. Abdoulhosseini Mr, Sohrabi Mb, Zolfaghari P, Mirkarimi S, Yahyaei E, Mirzapour A. Subclavian And Jugular Catheters Complications In Dialysis Patients. 2014.
25. Develter W, De Cubber A, Van Biesen W, Vanholder R, Lameire N. Survival and complications of indwelling venous catheters for permanent use in hemodialysis patients. *Artificial organs*. 2005;29(5):399-405.
26. Leung A, Heal C, Banks J, Abraham B, Capati G, Pretorius C. The incidence of peripheral catheter-related thrombosis in surgical patients. *Thrombosis*. 2016;2016.
27. Scholz G, Loewe K. Die Funktion der Vena subclavia und ihre Komplikationen aus pathologisch-anatomischer Sicht. *Med Welt*. 1969;41:2248-51.
28. Istrate N, MOȚA E, CANĂ-RUIU D. Central vein catheters complications at hemodialysed patients. *Age (years)*. 2009;49:13.1.
29. Mansfield PF, Hohn DC, Fornage BD, Gregurich MA, Ota DM. Complications and failures of subclavian-vein catheterization. *New England Journal of Medicine*. 1994;331(26):1735-8.